

Montgomery County Community College  
 BIO 131  
 Human Anatomy and Physiology I  
 4-3-3

**COURSE DESCRIPTION:**

A course employing a systems approach to the structure and function of the human body. Emphasis will be placed on biological chemistry, the cell, the skeletal, muscular, nervous and integument systems. Appropriate, relevant laboratory experiences will be employed to supplement and/or reinforce the lecture material. Dissection of preserved animal material is required. This course is subject to a course fee. Refer to <http://mc3.edu/adm-fin-aid/paying/tuition/course-fees> for current rates.

**PREREQUISITE(S):**

Successful completion of High School Chemistry taken within the last five years, with a "C" or better, or CHE 121, CHE 131, CHE 150, CHE 151 taken within the last five years with a "C" or better.

Completion of BIO 121 or BIO 151 within the last five years with a minimum grade of "C", or a passing grade on the MCCC Biology Placement Test.

**CO-REQUISITE(S):**

None

Upon successful completion of this course, the student will be able to:

LEARNING OUTCOMES	LEARNING ACTIVITIES	EVALUATION METHODS
	The course meets for six (6) hours each week; ideally be 3-4 hours lecture (including assessments) and 2-3 hours laboratory.	
1. Describe and define the interrelationship of the basic atomic structure of atoms to inorganic and organic molecular structures.	Lecture/Discussion	Quizzes Lecture Examinations
2. Identify and describe the relationship between inorganic and organic molecules to cells of the human body.	Lecture/Discussion	Quizzes Lecture Examinations

LEARNING OUTCOMES	LEARNING ACTIVITIES	EVALUATION METHODS
3. Identify how cells form tissues, how tissue structure relates to function, and to identify tissue locations within the body.	Lecture/Discussion Laboratory Exercises (details below) Laboratory Practical Examinations with Bones, Models, Dissection Specimens, etc.	Quizzes Lecture Examinations Lab Practicum and Exam
4. Identify major tissue types, major muscles, and bones of the human body.	Lecture/Discussion Laboratory Exercises (details below) Laboratory Practical Examinations with Bones, Models, Dissection Specimens, etc.	Quizzes Lecture Examinations Lab Practicum and Exam using Bones and Bone Models
5. Describe and define the above basic principles at the organ and organ system level, specifically for the integumentary, muscular, skeletal, and nervous systems.	Lecture/Discussion Laboratory Exercises (details below) Laboratory Practical Examinations with Bones, Models, Dissection Specimens, etc.	Quizzes Lecture Examinations Lab Practicum using Dissection Specimen and Models Lab Exam using Anatomical Models

At the conclusion of each semester/session, assessment of the learning outcomes will be completed by course faculty using the listed evaluation method(s). Aggregated results will be submitted to the Associate Vice President of Academic Affairs. The benchmark for each learning outcome is that *70% of students will meet or exceed outcome criteria*.

#### SEQUENCE OF TOPICS:

These outlines are intended to serve as guidelines for the minimum course content to be covered in BIO 131. Topics may be expanded upon if the instructor desires. The sequence in which systems are covered is entirely at the instructor's discretion. Along with straightforward memorization of material, understanding of physiological processes and concepts, application of knowledge and critical thinking are to be stressed. It is suggested that assessments have mixture of knowledge (20%), comprehension (50%) and higher order (30%) questions (percentages are approximate). This list of topics may be used to design specific objectives / learning outcomes for the course. Please feel free to contact any full-time A & P faculty member with concerns or questions.

### I. INTRODUCTION TO ANATOMY & PHYSIOLOGY

- A. Structural / hierarchical levels of body organization
- B. Definition of metabolism; include catabolism and anabolism
- C. Definition and examples of homeostasis;

1. Negative feedback
  2. Positive Feedback
- D. General Anatomic Orientation Terminology
1. Anatomical position
  2. Portions of the body and principle body cavities, including subdivisions; with arrangement of the membranes
  3. Terminology to indicate the body regions and terms of orientation
  4. Major planes of the body
  5. Regions and quadrants of the abdominopelvic cavity
- E. General overview of the structure, composition and function of all body systems
- F. Suffixes, prefixes and roots used in A&P terminology

## II. REVIEW OF GENERAL CHEMISTRY; BIOCHEMISTRY

*Note that the review material on general chemistry may be covered as Camtasia screencast. Biochemistry should be covered in class.*

- A. Atomic number, atomic mass and isotope
- B. Symbols of the common atoms and ions used by the human body
- C. Bohr model of atomic structure: protons, neutrons and electrons
- D. Definitions of molecule and compound
- E. Ionic bonds, oxidation, reduction, ions, cation, anion, ionization
- F. Non-polar covalent, polar covalent bonds and hydrogen bonds
- G. Chemical reactions: synthesis, decomposition, exchange, and reversible
- H. Chemical reactions; definitions of activation energy and catalyst
- I. Differences between organic and inorganic compounds
- J. Biological importance and characteristics of water
- K. Dissociation, acids and bases (include weak and strong), buffers, pH scale, salts and electrolytes. Include the physiological importance of each
- L. Definition of molarity, milliequivalents, and percent solutions (e.g., 0.9% NaCl)
- M. Structure and function of carbohydrates; include mono-, di-, and polysaccharides with examples of each.
- N. Structure and function of lipids; include saturated and unsaturated fats, oils, waxes, phospholipids, steroids, and eicosanoids
- O. Structure and function of nucleotide-based molecules: include DNA, RNA, ATP, ADP, cAMP, NAD, FAD.
- P. Structure and function of proteins; include the levels of protein structure; definition and importance of denaturation
- Q. Hydrolysis / digestion and dehydration synthesis / condensation reactions in the formation and degradation of macromolecules
- R. Identification and Recognition (nomenclature) of all above macromolecules: polymers and monomers
- S. Enzyme structure and function
  1. general equation for an enzyme reaction
  2. induced fit mechanism of enzyme action; include active site, substrate
  3. enzyme inhibition: competitive, non-competitive and allosteric
- T. Overview of metabolic pathways: definition of aerobic and anaerobic respiration with requirements and energy yields of each

### III. CELL ANATOMY & PHYSIOLOGY

*Note that the review material on organelles may be covered as Camtasia screencast. Plasma membranes should be covered in class.*

#### A. Microscopy

1. Function of the principle parts of the microscope
2. Definition of magnification and resolving power
3. Demonstrate competency using the microscope – be able to find specific structures as directed, e.g. nucleolus of an epithelial cell.

#### B. Plasma Membranes (PM)

1. Fluid mosaic model of membrane structure
2. Functions of the PM
3. Selective permeability of the PM
4. Transport across cell membrane including:
  - a. Diffusion: simple and facilitated diffusion, dialysis.
  - b. Role of electrical, chemical, and pressure gradients
  - c. Osmosis; include hypertonic, hypotonic and isotonic
  - d. Filtration with its physiological importance
  - e. Facilitated diffusion
  - f. Active transport; include the sodium-potassium pump, primary and secondary active transport
  - g. Cotransport: symport and antiport
  - h. Endocytosis; include pinocytosis, phagocytosis, and receptor-mediated endocytosis
5. Describe the physiological importance and give examples of items 4a-4g

#### C. Nature and function of cytoplasm

#### D. Structure and function of all membranous organelles

#### E. Structure and function of ribosome, cytoskeleton, centrioles, MTOC

#### F. Structure and function of membranous extensions including microvilli, cilia, and flagella.

#### G. Introduction to the resting membrane potential; role of Na<sup>+</sup>, K<sup>+</sup> anions

#### H. Introduction to signal transduction; include the basic steps in a generalized G protein coupled receptor

#### I. Review of cell cycle; include events of G<sub>1</sub>, S, G<sub>2</sub>, mitosis, and cytokinesis

#### J. Review of meiosis in terms of ploidy and cell type; definition of fertilization

#### K. Overview of DNA structure, genes and chromosomes; include review of chromosome / DNA replication

#### L. Overview of the general steps of gene expression; include transcription, translation, genetic code, mRNA, tRNA, and rRNA

#### M. Definition of Cell Differentiation

#### N. Overview of cancer using concepts above

1. Oncogenes and tumor suppressor genes
2. Benign vs. metastatic
3. Theory behind chemo- and radiation therapy

#### O. Concept of inherited diseases; e.g., cystic fibrosis, sickle cell

**IV. HISTOLOGY**

- A. Primary Germ Layers: endoderm, mesoderm, and ectoderm and a summary of the tissues developed from each.
- B. Epithelial Tissue
  - 1. Morphology, function and locations of simple, stratified, pseudostratified, squamous, cuboidal, columnar, and transitional epithelium
  - 2. Glandular epithelium; comparison endocrine and exocrine glands including structure and mode of secretion.
  - 3. Cell junctions: desmosomes, hemidesmosomes, tight junctions, gap junctions
- C. Connective Tissue: morphology, function and locations of areolar, adipose, collagenous, elastic and reticular tissues; hyaline, fibrous and elastic cartilage; bone and blood
- D. Membranes: mucous, serous, synovial, cutaneous
- E. Muscle: morphology, function and locations of skeletal, cardiac, and smooth muscle
- F. Nerve tissue: overview of neurons and glia
- G. Identification of tissue types in A-D from a microscopic slide, diagram or micrograph
- H. Physiology, signs and symptoms of inflammation; wound healing

**V. INTEGUMENTARY SYSTEM**

- A. General functions
- B. Structure and function of the epidermis (include the 5 layers, in order), dermis, and subcutaneous layer
- C. Origin, structure and function of hair
- D. Skin glands: include sebaceous, sudoriferous
- E. Identification of skin and its accessory organs from a microscopic slide, diagram or micrograph
- F. Thermal regulation via the skin; include the homeostatic mechanisms that respond to heat gain and loss
- G. Origin and function of pigmentation; include melanocytes and melanin
- H. Definition / classification of burns by depth; rule of nines
- I. Brief description of the 3 types of skin cancer; include causes

**VI. SKELETAL SYSTEM**

- A. Basic functions
- B. Bone classification according to shape
- C. Macroscopic structure of a typical long bone; include periosteum, epiphysis, diaphysis, endosteum, and medullary cavity; function and locations of red bone marrow and yellow bone marrow
- D. Comparison of compact and spongy bone; include locations of both
- E. Microscopic structure of bone; include osteon (Haversian system), osteoblast, osteocyte, osteoclast, lamellae, osteonic canal, canaliculi, Volkmann's canal; include function of each component and identify each from a diagram or slide
- F. Inorganic and organic composition and functions of osseous tissue

- G. Physiology of bone development
  - 1. Intramembranous ossification
  - 2. Endochondral ossification
- H. Physiology of bone growth
  - 1. Interstitial growth; function of Epiphyseal Plate
  - 2. Appositional growth
- I. Role of growth hormone, parathyroid hormone, calcitonin and sex hormones in bone growth and development
- J. Wolff's Law: bone growth in response to stress
- K. Bone fractures and repair; include simple, compound, traumatic (include major types), and pathological fractures
- L. Definition of rickets, osteomalacia, osteoporosis and osteomyelitis
- M. Definition of kyphosis, lordosis, and scoliosis
- N. Description of the 2 main subdivisions of the skeleton; include the primary subdivisions of each
- O. Bone anatomy: identification of the following on articulated or disarticulated bones. Use the following as a general guideline.
  - 1. Axial skeleton
    - a. frontal
    - b. parietal
    - c. temporal; include external auditory meatus, mastoid process, zygomatic process, styloid process, petrous portion, squamous portion, carotid foramen, jugular foramen
    - d. occipital; include foramen magnum, occipital condyles
    - e. sphenoid; include sella turcica, greater & lesser wings, pterygoid processes
    - f. ethmoid; include cribriform plate, perpendicular plates, crista galli, conchae
    - g. inferior nasal conchae
    - h. sutures; include lambdoidal, squamosal, sagittal, coronal
    - i. wormian/sutural bones
    - j. fontanel; include frontal / anterior, occipital / posterior, mastoidal, sphenoidal
    - k. maxilla; include infraorbital foramen, palatine process
    - l. palatine
    - m. zygomatic; include temporal process, zygomatic arch
    - n. vomer
    - o. lacrimal
    - p. nasal
    - q. mandible; include body, ramus, mandibular condyle, coronoid process, mental foramen, alveolar processes
    - r. hyoid
    - s. sternum; include manubrium, body, xiphoid process
    - t. ribs; include true, false, and floating with head and tubercle
    - u. vertebrae; distinguish atlas, axis, thoracic, cervical, and lumbar with the following bony markings: body, vertebral foramen, transverse process,

spinous process, superior articulating process, inferior articulating process, pedicle, lamina, transverse foramen (C), facet for rib tubercle (T), facet for head of rib (T)

- v. sacrum; include sacral foramen, sacral canal, sacral promontory
  - w. coccyx
2. Appendicular skeleton
- a. clavicle; include sternal end, scapular (acromial) end
  - b. scapula; include spine, glenoid fossa, coracoid process, acromion process
  - c. humerus; include head, anatomical neck, surgical neck, greater and lesser tubercles, intertubercular groove, deltoid tuberosity, coronoid fossa, olecranon fossa, trochlea, capitulum, lateral and medial epicondyles
  - d. radius; include head, radial tuberosity, styloid process
  - e. ulna, include coronoid process, olecranon process, styloid process, trochlear notch
  - f. carpals
  - g. metacarpals
  - h. phalanges; include proximal, middle & distal with proper numbering/names
  - i. os coxae; include ilium (with anterior superior iliac spine, iliac crest, sacroiliac joint), ischium (with ischial spine, ischial tuberosity), pubis (with pubic symphysis), acetabulum, obturator foramen; distinguish sexes
  - j. femur; include head, neck, fovea capitus, greater and lesser trochanters, medial and lateral condyles, medial and lateral epicondyles, linea aspera
  - k. patella
  - l. tibia; include anterior crest, medial and lateral condyles, medial malleolus, tibial tuberosity
  - m. fibula; include lateral malleolus
  - n. tarsals; include talus, calcaneus
  - o. metatarsals
  - p. phalanges; include proximal, middle, distal with proper numbering/names

## VII. JOINTS

- A. Distinguish the three main types of joints based on functional (synarthrosis, amphiarthrosis, diarthrosis) and structural (fibrous, cartilaginous and synovial) classification
- B. Synarthroses with examples
- C. Amphiarthroses with examples
- D. Structure of a synovial (diarthrotic) joint; include bursae, menisci, synovial fluid, ligaments. Classify as hinge, ball and socket, saddle, gliding, pivot, ellipsoid/condyloid.
- E. Description of cartilage, tendons and ligaments
- F. Body/joint movements; include flexion, extension, hyperextension, abduction, adduction, circumduction, rotation, pronation, Supination, inversion, eversion, protraction, retraction, elevation, depression, dorsiflexion and plantar flexion
- G. Anatomy of the knee joint; include structures specified in D.

- H. Overview of shoulder and hip joints as time permits. Be able to assign any ligament to a specific joint given its name, e.g. pubofemoral / hip joint
- I. Brief description of bursitis, sprain, dislocation, ankylosis, and the types of arthritis

## VIII. MUSCULAR SYSTEM

- A. Types of muscle tissue - distinguish between skeletal, smooth and cardiac with respect to: location, structure, arrangement, innervation
- B. Skeletal Muscle
  - 1. Characteristics including: excitability, contractility, extensibility, elasticity
  - 2. Functions including: movement, maintenance of posture, heat generation
- C. Hierarchy of skeletal muscle structure from gross to submicroscopic, including: origin, insertion, fascia, epimysium, perimysium, endomysium, fasciculi, myocytes, myofibrils, sarcomeres with markings, filaments
- D. Microstructure of muscle cell / fiber / myocyte; including sarcolemma, T-tubule, sarcoplasmic reticulum, triad, sarcoplasm, mitochondria, nuclei, anatomy and arrangement / composition of thick and thin filaments (actin, myosin, tropomyosin, troponin and thin filament activation by  $\text{Ca}^{++}$ ). Use models and slides
- E. Motor unit - define and describe structure and function
  - 1. All-or-none principle
  - 2. Graded strength and recruitment
- F. Neuromuscular junction - describe anatomy and physiology including ACh, AChE, synaptic cleft, ACh receptor, motor end plate
- G. Physiology of contraction beginning with receipt of a threshold stimulus by motor neuron through relaxation of muscle. Include role of stimulus,  $\text{Ca}^{+2}$ , ACh, AChE, membrane ion channels (chemical, voltage dependent and independent) depolarization, repolarization, Na/K Pumps, sarcoplasmic reticulum, Ca-ATP / calsequestrin and thick and thin filament interactions, refractory period
- H. Define and describe simple twitch (latent, contraction & relaxation phases), incomplete & complete, tetany, wave summation, treppe. Include myograms of each
- I. Describe several factors controlling strength and duration of a contraction
- J. Compare slow oxidative / red, fast glycolytic / white, fast oxidative / pink fibers with regard to: myoglobin content, glycogen storage, speed, endurance, energy source, strength, diameter, mitochondria, sarcoplasmic reticulum, number of myofibrils
- K. Muscle Energetics
  - 1. Role of glucose and fatty acids as fuels
  - 2. ATP as immediate source
  - 3. Glycogen - glucose - ATP system
  - 4. Creatine phosphate
  - 5. Aerobic and anaerobic glycolysis, lactic acid generation
- L. Muscle fatigue: definition and theories regarding cause



- M. Define and describe: origin, insertion, agonist / prime mover, synergist, antagonist, tonus / posture, flaccidity, atrophy, hypertrophy, isotonic and isometric contractions
- N. Identify locations on models and functions of human muscles. For muscles marked with an asterisk, know action / function only.
1. Muscles of facial expression: epicranii, orbicularis oculi, buccinator, orbicularis oris, zygomaticus, platysma
  2. Muscles of mastication: masseter, temporalis, medial pterygoid, lateral pterygoid
  3. Muscles moving the head: sternocleidomastoid, capitis group (splenius, semispinalis\*, longissimus\*)
  4. Muscles that move the pectoral girdle: trapezius, serratus anterior, rhomboideus major, pectoralis minor, levator scapulae
  5. Muscles that move the upper arm: coracobrachialis, teres major, pectoralis major, latissimus dorsi, supraspinatus, subscapularis, deltoid, infraspinatus, teres minor
  6. Muscles that move the forearm: biceps brachii, triceps brachii, brachialis, brachioradialis, supinator, pronator teres, pronator quadratus\*
  7. Muscles that move the wrist & fingers: flexor carpi radialis, palmaris longus, flexor carpi ulnaris, extensor digitorum, extensor carpi ulnaris, extensor carpi radialis longus, extensor carpi radialis brevis
  8. Muscles of the abdominal wall including External oblique, Internal oblique, Rectus abdominis, Transversus abdominis
  9. Breathing muscles: diaphragm, internal intercostals, external intercostals
  10. Muscles acting on thigh including gluteus maximus, Gluteus medius and minimus, tensor fasciae latae, iliacus, psoas major, gracilis, adductor magnus and longus
  11. Muscles that move the lower leg including hamstrings (semitendinosus, semimembranosus, and biceps femoris), sartorius, quadriceps femoris (rectus femoris, vastus lateralis, vastus intermedius\*, vastus medialis)
  12. Muscles that move the ankle, foot and toes including tibialis anterior, peroneus / fibularis tertius\*, gastrocnemius, soleus, tibialis posterior, peroneus / fibularis longus

## IX. NERVE TISSUE

- A. General functions
- B. Divisions and subdivisions of nervous system
  1. Central Nervous System / CNS: brain and cord
  2. Peripheral Nervous System / PNS: cranial and spinal nerves, afferent, efferent, autonomic
- C. Histology
  1. Neuroglia - Describe structure and function of 4 CNS (astrocytes, ependyma, oligodendrocytes, microglia) and 2 PNS glia (Schwann cells, satellite cells)

2. Generalized neuron structure: dendrites, receptors, perikaryon, nucleus, Nissl substance, axon hillock, axon, collateral axons, neurilemma, myelin sheath, telodendria, synaptic knobs and vesicles). Axonal transport.
  3. Neuronal classification by structure (unipolar, bipolar, multipolar) and function; neuron. sensory and motor neurons.
- D. Define: ganglion, nucleus, tract and nerve
- F. Ionic Basis For RMP Including: role Of Na/K Pump, Na/K/cation permeability, gated channels including leakage, chemically/ligand, mechanically, voltage regulated types.
- G. Describe graded potentials, including EPSP, IPSP, temporal and spatial summation, facilitation, inhibition
- H. Action potential generation
1. Multidirectional from point of stimulation
  2. Events occurring surrounding generation of an action potential including stimulus, threshold, depolarization, repolarization, absolute and relative refractory periods, spatial and temporal summation, all-or-none
- I. Synaptic Transmission
1. Transmission, receptors, neurotransmitters, cholinesterase, recycling
  2. Integration as a function of the postsynaptic membrane
  3. Examples of effectors and responses
- J. Compare continuous and saltatory conduction including the role of myelin
- K. Comparisons of types A, B, C neurons by axon diameter, speed, structure, myelination, and by location
- L. Circuit patterns including, convergence, divergence, reverberating, parallel-after-discharge

## **X. CENTRAL NERVOUS SYSTEM**

- A. Major subdivisions and development of forebrain (cerebrum and diencephalon), midbrain, hindbrain (pons, medulla and cerebellum). Identify/define "brainstem."
- B. Structures protecting brain and cord with locations including muscle, bone, meninges (dura, arachnoid, pia and appropriate spaces), CSF
- C. Functions, formation, flow, locations, reabsorption of CSF, including ventricular system, role of choroid plexuses and arachnoid villi. Define hydrocephalus.
- D. Medulla, pons, cerebellum, midbrain, thalamus, epithalamus, hypothalamus, posterior pituitary, and cerebrum including hemispheres, lobes. Comment on right vs. left hemisphere specialization.
- E. Basal nuclei function and the role of dopamine; Parkinsonism and Huntington disease.
- F. Functional regions of the brain: Reticular formation / RAS and Limbic System. Components and function of each.
- G. Brains waves and an overview of the stages of sleep.
- H. Control of voluntary and involuntary movement and posture including roles of pyramidal / direct and extrapyramidal / indirect pathways; significance and roles of the precentral gyrus, midbrain, pons, medulla oblongata / decussation, cerebellum and basal nuclei. Focus on the lateral corticospinal tract with roles of the extrapyramidal tract

- I. Sensory areas in parietal, occipital, and temporal lobes including primary somatosensory cortex and association areas in various regions of the cortex
- J. Cross sectional anatomy and function of the spinal cord including gray matter, horns, white matter, median sulcus/fissure, central canal, gray commissure, columns, tracts (fasciculi), meninges
- L. Longitudinal sectional anatomy and function of the spinal cord including origination and ending at L2, conus medullaris, cervical and lumbar enlargements, meninges (filum terminale, epidural, and subarachnoid spaces), cauda equina, ascending and descending tracts
- M. Clinical significance and safety of using L3, L4 as site for lumbar puncture, spinal anesthesia and analgesia
- N. Functions of spinal cord - control of reflex activity and communication to from brain and from / to body. Include major motor (pyramidal / direct and extra-pyramidal / indirect) and major sensory tracts
- O. Define neural tube defects, spina bifida, anencephaly, and other major NS disorders.
- P. Locate major brain and cord structures on models, diagrams and dissected sheep brains.

## **XI. PERIPHERAL NERVOUS SYSTEM & REFLEXES**

- A. Cranial nerves including origin, order, names, functions and identify which are sensory, motor or mixed
- B. Spinal Nerves
  - 1. 31 pairs (8 cervical, 12 thoracic, 5 lumbar, 5 sacral and 1 coccygeal pair)
  - 2. Anatomy from model/diagram including formation and origination from fusion of dorsal and ventral roots, major rami (dorsal, ventral and rami communicantes) and functions
  - 3. Define plexus; identify 5 major plexuses (cervical, brachial, lumbar, sacral and coccygeal) and major nerves (e.g. phrenic, radial, median and ulnar nerves, femoral, sciatic) originating from each; identify which spinal nerves do not form plexuses
  - 4. Dermatomes and their significance
- C. Reflexes
  - 1. Distinguish between autonomic and somatic, monosynaptic, polysynaptic, ipsilateral, contralateral.
  - 2. Diagnostic importance in spinal cord injury, stroke and to measure overall nervous system reactivity
  - 3. Diagram/explain role of cord, receptors and neurons in knee jerk reflex and crossed extensor reflex

## **XII. AUTONOMIC NERVOUS SYSTEM**

- A. Distinguish between somatic and autonomic effectors
- B. Comparisons between somatic and autonomic (parasympathetic and sympathetic branches) with regard to:
  - 1. Functions - voluntary movement vs. "rest and digest" vs. "fight-or-flight"

2. Origination - outflow from CNS by location; include thoraco-lumbar in sympathetic vs. cranio-sacral for parasympathetic
3. Number of neurons to effectors - type, structure and size of pre and postganglionic motor neuron(s) in SNS and ANS; include chain ganglia, terminal ganglia
4. Neurotransmitters used, receptors stimulated, extent of divergence, duration of effects
5. Receptor types: nicotinic and muscarinic cholinergic receptors;  $\alpha_1$ ,  $\alpha_2$ ,  $\beta_1$ ,  $\beta_2$  and  $\beta_3$  receptors & their responses
6. Compare and contrast the effects of sympathetic and parasympathetic stimuli on pupil of eye, salivary glands, airway, heart, GI tract, blood vessel diameter, sweat glands, genitalia.
7. Dual innervation, commenting on exceptions

### **XIII. GENERAL AND SPECIAL SENSES**

#### A. Sensation

1. Sensory receptors; include classification based on location and mechanism of stimulation
2. Sensory adaptation

#### B. Overview of general / somatic senses; include tactile, thermoreceptive, pain, and proprioceptive sensations

#### C. Special Senses – *emphasis should be on structure and function*

1. Eye
  - a. Anatomy; include the palpebra, conjunctiva, lacrimal glands, extrinsic muscles, fibrous tunic (include cornea, sclera), uvea (include choroid coat, ciliary body, iris, pupil) and retina (include rods, cones, etc., macula lutea, fovea centralis, optic disk), lens, eye cavities and humors.
  - b. Physiology of vision; include basic processes and structures involved, accommodation, photoreception, nerve pathway to brain, stereoscopic vision
2. Ear
  - a. Anatomy; include the external (include pinna and external auditory meatus), middle (include auditory ossicles, Eustachian / auditory tube) and inner (include cochlea, organ of Corti, semicircular canals, cranial nerve VII) ear, tympanic membrane, oval window, round window
  - b. Physiology of hearing; include basic processes and structures involved, pathway of nerve impulse to the brain
3. Overview of olfaction and gustation; include structures, physiology, cranial nerves

Laboratory Topics: Microscopy, histology, gross anatomy and the skeletal, muscular and nervous systems

**LEARNING MATERIALS:**

Required Textbook:

Marieb, Elaine & Hoehn, Katja (2016) Human Anatomy and Physiology, Pearson Publishers.

Required Laboratory Manual:

Marieb, Elaine, Human A&P Lab Manual Custom for MCCC, Pearson Custom Publishing.

Other learning materials may be required and made available directly to the student and/or via the College's Libraries and/or course management system.

**COURSE APPROVAL:**

Prepared by: Albert A. Baccari	Date: 3/26/1998
Revised by: Marie Richard-Yates	Date: 3/2005
Revised by: Albert Baccari and Judith Cunningham	Date: 2/3/2009
Revised by: T. Patrick Abrahams	Date: 4/2011
Interim VPAA/Provost Compliance Verification: Victoria L. Bastecki-Perez, Ed.D.	Date: 6/21/2011
Revised by: Christopher Harendza, Ph.D.	Date: 7/2012
VPAA/Provost or designee Compliance Verification: Victoria L. Bastecki-Perez, Ed.D.	Date: 6/10/2013
Revised by: Debbie Dalrymple	Date: 05/27/2016
VPAA/Provost or designee Compliance Verification: Victoria L. Bastecki-Perez, Ed.D.	Date: 05/27/2016
Revised by: Christopher Harendza, Ph.D.	Date: 1/4/2017
VPAA/Provost or designee Compliance Verification:	Date: 1/25/2017



*This course is consistent with Montgomery County Community College's mission. It was developed, approved and will be delivered in full compliance with the policies and procedures established by the College.*